

NEUROIMAGING AND THE COURTS: PART I

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In areas of vigorous clinical debate or rapid technological change, courts often have struggled to properly interpret medical data. Over the last twenty years, society has witnessed a remarkable evolution in medicine's ability to detect neuropathology using new imaging techniques. This article will discuss how various courts have attempted to adjudicate cases that involved intracranial imaging.

The introduction of the first computed tomographic (CT) device by Hounsfield in 1972^{1,2} provided the opportunity for earlier and less invasive diagnoses of intracranial pathology. Subsequent generations of scanners have incorporated improvements in design, speed and image resolution to provide clinicians with invaluable information not only about the brain but the entire body.

Another modern imaging technique, magnetic resonance imaging (MRI), employs a physical phenomenon, nuclear magnetic resonance, discovered by Purcell and Bloch in the 1940s.^{3,4} Following two decades of use as a chemist's tool, various researchers began investigating the medical applications of MRI. Conceived originally as a cancer detection technique, the startling resolution of images produced by MRI, without exposing patients to radiation, generated considerable clinical enthusiasm. By 1985, over 200 MRI scanners had been installed worldwide;⁵ by 1990, thousands.⁶

Against the backdrop of these relatively rapid technological developments are the conflicting demands placed upon those clinicians who must decide if and when to use them to benefit their patients. Issues concerning safety, cost and accessibility were raised early in the use of CT and MRI, and the debates surrounding these issues have continued. Nevertheless, some areas of agreement among clinicians have resulted from greater experience with the technology. For instance, if any consensus exists regarding the indications for neuroimaging, it is that not every patient with a headache or backache should be scanned.

Another clinical challenge posed by CT and MRI surrounds the interpretation, i.e., clinical significance, of the images. Initially, "abnormalities" were detected for which the incidence in the general population was unknown. The resulting neuroradiologic "epidemics" of multiple sclerosis (UBOs), cerebral atrophy, temporo-mandibular joint dysfunction and lumbosacral disc bulges were, in effect, cured with greater understanding of the new technology.⁶

Mirroring the difficulties that modern neuroimaging has presented medicine are those that the legal system has been forced to confront. In professional liability cases, the central issue was whether or when a scan should have been performed. In other civil cases, the existence or extent of injury has often depended upon the evidence reached by scanning. In criminal law, particularly that involving capital offenses, scans have played a role in sanity determinations.

Reviewing certain legal cases allows us to see how specific courts have accommodated this evolving technology.

PROFESSIONAL LIABILITY

Several cases involving the failure to timely diagnose brain tumors by CT scan are noteworthy. The first concerned a psychiatric patient who committed suicide in 1976.⁷ Autopsy revealed a parasagittal meningioma. Despite numerous hospitalizations during the previous four years for symptoms of headache, nystagmus and gait disturbance, no scan had been performed. Medical testimony was directed by the court to consider "the question of whether, under the circumstances, the failure to call for diagnostic brain tests constituted negligence." Given the novelty of CT scanning at the time, conflicting expert testimony was presented.

Without specifically addressing the issue of access to CT scanning in 1976, the court felt that the plaintiff's expert was persuasive and concluded that the patient's "... symptoms and medical records indicated the need for a *relatively simple* [emphasis added] diagnostic test, which would have revealed the tumor and led to its removal."

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Finally, the court held that "... the undiagnosed tumor seriously aggravated a pre-existing mild paranoid state, and was the proximate cause of [the patient's] suicide." Damages were awarded to the patient's estate.

The second case concerned a patient treated at several V.A. hospitals for the diagnoses of multiple sclerosis and schizophrenia.⁸ A physician who saw the patient in 1976 noted that "the possibility of a brain stem lesion, quite capable of causing all of the patient's signs, should be excluded." Another physician ordered a CT scan with instructions to "look for signs of M.S. or brain tumor." Unfortunately, the scan was never performed. Three and a half years later, with the patient experiencing progressive brain stem signs, CT scan demonstrated a large posterior fossa epidermoid tumor.

The parties to the suit agreed that the failure to perform the scan in 1976 fell beneath the medical standard of care of the community. The defendant admitted that such a scan would have disclosed the brain stem tumor. Suit was brought on several issues concerning only damages. Considering how poorly brain stem pathology was demonstrated by early CT scans, one wonders whether the defense could have argued that the tumor would not have been detected in 1976 with the then existing technology. However, since the patient failed to receive the scan through a flagrant failure to execute a test ordered by a physician, there may have been an unwillingness to contest liability.

In the third case, the U.S. Eighth Circuit reviewed a lower court's ruling that attempted to distinguish between offering a CT scan to a patient and recommending one.⁹ In early 1976, a woman was evaluated by a neurologist for persistent headaches. The neurologist informed the patient that she was most likely suffering from tension headaches and that his diagnosis could be more certain if she were to undergo a CT scan. After hearing about the risks of radiation and allergic reactions to contrast material, the patient decided against the scan.

The patient was seen at the same institution for a new complaint in 1978. She told a different physician that she was no longer bothered by headaches. She returned in 1981 complaining of headaches that she attributed to sinus trouble. After examining the patient, the neurologist who had initially evaluated her in 1976 again concluded that her clinical course and findings were inconsistent with a brain tumor. He reiterated that a CT scan was the best way to rule out a tumor and reviewed the risks of the study; she declined the scan. In March 1982, the patient could not be aroused from sleep. Soon thereafter, a large meningioma was detected. Following surgery, the patient was left with profound neurologic deficits.

A suit for negligence was brought. Plaintiff's experts presented evidence that the treating physicians should have recommended a CT scan to the patient and refrained from rendering a final diagnosis without one. The defendants and their experts presented evidence that the standard of care called for the defendants to offer the patient a CT scan, that they did so repeatedly, and that it was reasonable to formulate a diagnosis without the scan. The jury in the trial court determined that the defendants were not negligent, and the appellate court affirmed the verdict.

A jury's ability to understand the results of neuroimaging studies can prove crucial. In 1987, a judge over-turned a verdict for a plaintiff, largely due to the jury's confusion over the clinical significance of sequential CT scans.¹⁰ A man presented to the emergency room in February 1983 with shooting pains in his temporal area. He reported that he had hit his head a day earlier while working under his car. After an examination, the patient was given a mild analgesic and discharged. Three weeks later, he returned complaining of persistent frontal headaches. He was re-evaluated and diagnosed as having a post-traumatic headache. Two weeks later, the patient again returned and was subsequently referred to another hospital for further treatment.

The following day, the man was evaluated in the emergency room of the second hospital for his headache, then discharged. Within hours, he was admitted to that facility after suffering several seizures. A CT scan was performed and interpreted as normal. Over the next day, the patient became increasingly disoriented, and repeat CT scanning revealed a subdural abscess. The patient died several hours after the second scan.

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A negligence suit brought against the first hospital hinged upon the failure to order a CT scan during the patient's three visits there. No evidence was presented that the initial CT scan at the second hospital was not performed or interpreted according to the standard of care. Nevertheless, the jury, apparently not understanding the significance of the normal initial scan, found for the plaintiff. The judge, however, noted that "[t]he uncontradicted evidence adduced at trial demonstrates that even if [defendant hospital] had ordered further testing of [plaintiff], including a CAT scan, the results of such testing would not have indicated to a reasonable physician that the decedent had developed an infection..." The court reversed the jury's decision and awarded the hospital a judgement notwithstanding the verdict.

In his opinion, the judge did not mention whether either or both scans were performed with contrast. If the initial scan was done without contrast and the repeat with contrast, a more interesting question may have been whether the failure to perform an earlier *contrast* CT scan on this patient, later found to have a subdural abscess, represented negligence under these clinical circumstances.

ASSESSING DAMAGES

Two 1990 decisions demonstrate the use of MRI to assess the presence or extent of brain damage resulting from negligence.

In 1985, a 57 year old woman was admitted to a hospital with complaints of severe headache, nausea and vomiting.¹¹ While hospitalized, she was treated for dehydration with large amounts of D5W and given reserpine to control her blood pressure. Laboratory studies to monitor fluid and electrolyte status were not performed. Four days later, the patient was transferred to a larger hospital where a serum sodium of 96 mEq/L was found on admission. Unfortunately, the hyponatremia was aggressively treated with copious amounts of hypertonic sodium infusions. Within a short time, the patient deteriorated neurologically. She never fully recovered.

At trial, a neurologist testified that, one year later, the patient continued to experience a receptive dysphasia, a dysarthria and a gait disturbance. An MRI confirmed his clinical impression of two separate neurological problems, a diffuse cerebral injury secondary to hyponatremia and central pontine myelinolysis, a condition attributed to the overly rapid correction of the electrolyte deficiency with a characteristic appearance on scan. It should be noted that, before advanced neuroimaging techniques became available, both diagnoses were made clinically and verified only by post-mortem examination.

Interestingly, the court found that both conditions arose out of the substandard care rendered by the physician at the first hospital. It reasoned that the central pontine myelinolysis was a "foreseeable consequence of his negligence" in that it was a manifestation of "[t]he risk of further injury by other health care providers whose services were made necessary by the original negligent act."

In another negligence action, opposing experts argued over the interpretation and clinical significance of an MRI in determining the extent that a child's neurological damage resulted from substandard perinatal care five years earlier.¹² After finding that the attending physician's failure to promptly intubate a neonate was a breach of the standard of care, the court requested that an MRI be performed. Three neuroradiologists reviewed the scan, and all agreed that the minimal abnormalities on the child's MRI were non-specific. Two opined that the MRI showed no evidence of asphyxic brain damage, while the third expert maintained that children with asphyxic brain damage can have normal MRIs.

Of the two neuroradiologists who stated that the MRI was normal and did not substantiate a diagnosis of perinatal asphyxia, the court particularly focused upon one who added that a clinical diagnosis of perinatal asphyxia might not be supported by MRI. Specifically, that expert distinguished between the clinical judgement of perinatal asphyxia and proof of perinatal asphyxia. Moreover, he asserted that in "documented" cases of perinatal asphyxia, the MRI is never normal and suggested that a clinical diagnosis of perinatal asphyxia could be wrong as often as 20% of

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the time. In summary, his testimony indicated that the court should not rely upon a clinical diagnosis of perinatal asphyxia without imaging “proof.”

The court, concluding that not all neuropathology appears on even the best scans, adopted the opinion of the third expert that a normal MRI is not inconsistent with perinatal asphyxia. It was particularly critical of the other expert’s inability to convincingly explain what constituted a “documented” case of perinatal asphyxia. Finally, the court found that the plaintiffs had met their burden of proof in demonstrating that failure to intubate the infant promptly was the proximate cause of her condition, and it awarded damages.

A recent case considered the issue of whether a court could order sedation for an MRI to establish the etiology of a neurologic condition.¹³ A plaintiff alleged that defendant’s negligence caused him to suffer brain damage at birth resulting in cerebral palsy. The defendant asked the court to require an MRI scan of the head to “further investigate the nature and cause of the cerebral palsy.” The plaintiff objected because sedation with chloral hydrate and hydroxyzine hydrochloride would be necessary and would be dangerous to the patient. A conflict between medical experts ensued concerning the safety of sedation. Eventually, the trial court ordered the plaintiff to submit to the scan within 21 days.

On appeal, the plaintiff argued that the trial court abused its discretion in ordering him to submit to an MRI scan. Distinguishing the facts in this case from an earlier decision that ordered testing,¹⁴ the appellate court reversed, stating, “there is no evidence before this court to the effect that the MRI results will resolve any major legal issue.” According to the appellate court, the crucial distinguishing feature of the earlier decision was that “the court stated that the MRI, under sedation, would give clear test results and definitively resolve a major legal issue as to whether the minor plaintiff’s medical condition was congenital.”

In the earlier case, a previous CT scan done without sedation suggested schizencephaly, a deformity involving clefts formed in the cerebral hemisphere due to maldevelopment of the cerebral mantle in the second month of gestation. Unfortunately, motion artifacts prevented the neuroradiologist from being more definitive in his diagnosis. Based upon the neuroradiologist’s testimony that he could tell whether the plaintiff (who was alleging obstetrical injury) suffered from schizencephaly if a scan was done under sedation, an order for repeat testing was given. In the instant case, however, the moving party was too vague as to the scan’s purpose, and the court denied the motion.

CRIMINAL LAW

Two early cases involving the use of CT scan in criminal cases illustrate the legal community’s hope (or distress) that medical science had developed a definitive sanity test. A man was convicted of two counts of first degree murder in Massachusetts. On appeal in 1977, one issue was the lower court’s order that the accused submit to a CT scan as requested by a court-appointed psychiatrist.¹⁵ The accused argued that the order exceeded the scope of authority to order psychiatric testing and that the psychiatrist’s testimony that he refused testing violated the accused’s privilege against self-incrimination.

Since the defendant did not submit to any psychiatric examination, the Supreme Court of Massachusetts declined to decide if the order for a CT scan exceeded the authority of the lower court. It did, however, preserve future use of the technology by noting that “there is no constitutional ground for challenging a court order that a defendant submit to physiological tests, such as a brain wave or a CAT scan examination, accompanying a properly ordered psychiatric examination.”

In 1977, the U.S. Court of Military Appeals reversed a service member’s murder conviction, apparently using the case to alter the insanity standard recognized by the military criminal justice system. The appellant was tried again and convicted. Appellant’s counsel contended, among other things, that a CT scan of appellant’s brain should have been performed before the neurological consultation to establish mental responsibility at the time of the offense.

As the Navy Court of Military Review on a second appeal in 1979 recounted, “[i]n essence, trial defense argued that further neurological testing was indicated ... because of asserted new developments in the field of psychiatry and neurology during the interim between appellant’s first trial and the rehearing.”¹⁶ The military judge granted the request and “strongly suggested” that the government cooperate in obtaining the scan.

The difficulties of CT scanning in the late seventies soon became painfully evident to that court. Although the trial was in North Carolina, the accused needed to be transported to Baltimore for his test. The neurologist who ordered the scan, as well as the radiologist who performed it, had little experience in interpreting the study. Their interpretations of the images were then reviewed by a neurosurgeon in Boston. The neurosurgeon had been contacted by defense counsel who had come across his name while reading background material on the case. Disagreement then arose as to whether the scan was normal, and additional testing, including a pneumoencephalogram, was requested. The court, attempting to obtain a pneumoencephalogram, was over-whelmed by the attendant logistics and ultimately directed the experts for both sides to work with what they had. The Navy Court of Military Review agreed with the order and let the lower court’s conviction stand.

In the next issue of Open File, court decisions in which modern imaging studies of the spine, spinal cord and nerve roots played a key role will be presented and discussed.

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